Baltic Journal of Health and Physical Activity

Volume 10 | Issue 4 Article 16

2018

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Recommended Citation

Gorkem U, Yamaner F, Demi̇rkan E, Inal HA. Does the spinning exercise affect the ovarian reserve in reproductive-young women? Balt J Health Phys Act. 2018;10(4): 175-181. doi: 10.29359/BJHPA.10.4.16

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Baltic Journal of Health and Physical Activity 2018; 10(4): 175-181
Journal of Gdansk University of Physical Education and Sport
e-ISSN 2080-9999

ORIGINAL

doi: 10.29359/BJHPA.10.4.16

Does the spinning exercise affect the ovarian reserve in reproductive-young women?

Authors' Contribution:
A Study Design
B Data Collection
C Statistical Analysis
D Data Interpretation
E Manuscript Preparation
F Literature Search
G Funds Collection

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abstract

Background: The aim of this study is to evaluate whether spinning exercise may have an impact on ovarian reserve capacity in reproductive young women.

Material and methods: 48 healthy women were included into this prospective cohort study and randomly categorized into control (n = 14) and experimental groups (n = 12). Spinning exercise sessions were conducted for 50 minutes three times a week for 8 weeks in the study group. The control group did not exercise. Immediately before and after the spinning program, each participant underwent the measurements of the body mass index, the waist circumference, the hip circumference as well as serum anti-müllerian hormone (AMH), estradiol (EM), follicle stimulating hormone (FSH) and luteinizing hormone (LH) levels.

Results: There were significant differences in both of group in terms of antropemetric features (body weight, BMI, fat percent, waist circumference and hip circumference). There was only a significant difference of AMH in the experimental group.

Conclusions: Spinning exercise would be an important cause of associated with a decreased serum AMH level in reproductive young women. Further research should expand the finding by questioning whether intensity or practicing is an important mechanism in reproductive young women.

Key words: exercise, spinning, ovarian reserve, AMHh anti-müllerian hormone.

article details

Article statistics: **Word count:** 1,976; **Tables:** 3; **Figures:** 2; **References:** 41
Received: December 2017; **Accepted:** June 2018; **Published:** December 2018

Full-text PDF: http://www.balticsportscience.com

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Indexation: Celdes, Clarivate Analytics Emerging Sources Citation Index (ESCI), CNKI Scholar (China National Knowledge Infrastructure), CNPIEC, De Gruyter - IBR (International Bibliography of Reviews of Scholarly Literature in the Humanities and Social Sciences), De Gruyter - IBZ (International Bibliography of Periodical Literature in the Humanities and Social Sciences), DOAJ, EBSCO - Central & Eastern European Academic Source, EBSCO - SPORTDiscus, EBSCO Discovery Service, Google Scholar, Index Copernicus, J-Gate, Naviga (Softweco, Primo Central (ExLibris), ProQuest - Family Health, ProQuest - Health & Medical Complete, ProQuest - Illustrata: Health Sciences, ProQuest - Nursing & Allied Health Source, Summon (Serials Solutions/ProQuest, TDOne (TDNet), Ulrich's Periodicals Directory/ulrichsweb, WorldCat (OCLC)

Funding: This work is supported by the Scientific Research Unit of the Hitit University, Corum, Turkey (Grant number: 20796219- E-14-159).

Conflict of interests: Authors have declared that no competing interest exists.

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INTRODUCTION

Infertility is defined as a destructive life crisis for couples, and it has a particularly severe effect on women. Especially age is also an important factor influencing woman's ability to be pregnant, as the ovarian reserve and the quality of oocytes decrease with age. Beginning at the age of 32, women's fertility significantly declines, and more rapidly after the age of 37 [1, 2]. In addition, physical activity is known to be an important component in daily life for health; the relationship between ovulation and exercise is considered as multi-factorial. Therefore, no study suggests clear recommendations concerning exercise regimes [3].

Many studies [4‒7] have confirmed that regular exercise has been associated with many positive effects on the body function, such as insulin sensitivity, weight loss in the visceral adipose tissue, and improved cardiovascular function; however, intense exercise has been reported to cause luteal phase defects, such as menstrual dysfunctions [8‒10]. Various hormones and peptides, such as follicle-stimulation hormone (FSH), inhibin B, 17-β-estradiol and anti-Müllerian hormone (AMH), are known to have important roles in the modulation of the ovarian reserve [11]. Ovarian reserve tests are aimed at identifying individuals at risk of pregnancy achievement. Over the past 20 years, efforts to measure the ovarian reserve describing the quantity and the quality of the ovarian follicular pool have become popular. The anti-müllerian hormone (AMH) test is increasingly used in clinical practice as a marker of the ovarian reserve. Anti-müllerian hormone is secreted by granulosa cells of preantral and small antral follicles. Small antral follicles are likely to be the primary source because they contain large numbers of granulosa cells and more developed microvasculature [14, 15]. AMH is considered to be a crucial factor in inhibition of FSH-dependent follicologenesis and follicle selection. AMH also exhibits little variation within and between cycles [16]. Although it functions primarily as an autocrine and paracrine regulators of follicular development, AMH appears in measurable amounts in serum [17]. Therefore, prediction of the ovarian response during in vitro fertilization treatment (IVF), prediction of age at menopause and diagnostic purposes such as the identification of women with premature ovarian failure (POF) or polycystic ovarian syndrome (PCOS) may be possible [12, 13, 15].

Studies have remained inconclusive about the effect of determinants such as the body mass index (BMI), waist circumference (WC) or physical exercise on the ovarian reserve [18, 19]. Recreational physical activities, such as spinning, running, swimming and aerobics, are among the most favored exercises to overcome physical inactivity. Spinning® (a registered trademark of Madd Dog Athletics, Inc.) is an indoor stationary cycling program becoming a popular form of group exercise taught in health and fitness facilities worldwide [20]. It is especially designed for improvement in cardiovascular fitness, muscle tone and exercise endurance [21]. Spinning has an advantage of having a lower impact on the joints compared with running and aerobics [22, 23]. Spinning programs are usually 40 to 60 minutes' variable intensity workouts [20]. The intensity of spinning exercise was demonstrated to range from moderate to very heavy [24]. Among cardiovascular activities, Spinning® cycle indoor has gained popularity within recent years in the fitness industry being an alternative form of exercise that is performed to music in a group exercise setting that may assist in achieving the recommended levels of physical activity for some individuals. A few studies have analyzed the intensity pattern of Spinning®

cycle indoor and concluded that the Spinning® routine is a strenuous physical activity [25, 26]. Despite its worldwide popularity, little research exists that quantifies the ovarian reserve response to spinning.

The aim of this study was to investigate whether there is an impact of spinning exercise on anthropometric features and various hormones in the reproductive-aged women. It was hypothesized that intensive exercise could affect negatively the ovarian reserve in reproductive-aged women.

MATERIAL AND METHODS

SUBJECTS

In total, 26 healthy young women who met the inclusion criteria participated in this prospective cohort study. The participants were randomly categorized into two groups: the experimental group (n = 12) and the control group (n = 14). The study was approved by the local ethics committee (reference number: B.30. 2.ODM.0.20.08/1243), and informed consent prior to the study was obtained from all participants. The study was carried out between September and December 2014 at the Reproductive Endocrinology Department, the Hitit University Medical Faculty, Corum, Turkey.

PROCEDURES

Exclusion criteria were >35 years of age, pregnancy, diagnosed cases of premature ovarian failure, current use of medications influencing reproductive functions, hyperprolactinemia, conditions known to affect reproductive functions including hysterectomy and/or oopherectomy, endometriosis, ovarian masses, smoking, pelvic surgery, use of hormonal contraceptives, systemic diseases including thyroid diseases, heart diseases, inflammatory and autoimmune diseases, diabetes mellitus.

Immediately before and after the spinning exercise program, each participant underwent the measurements of the body mass index (BMI), the waist circumference (WC), the hip circumference (HC), the waist and hip ratio (WHIR). In addition to serum AMH, estradiol (EM), follicle stimulating hormone (FSH) and luteinizing hormone (LH) measurements were taken before and after the spinning exercise program. The body mass index (BMI) was calculated by dividing the weight in kilogram by the height in meters squared (BMI = Weight (kg)/ Height (m^2)). The control group did not exercise.

Spinning sessions were performed in the afternoons on spinning bikes and lasted 50 minutes for each session three times a week for 8 weeks in the experimental group. Exercise intensity was performed as 70 %, and the percentage heart rate reserve was calculated using the heart rate at rest condition and the maximum heart rate, which is calculated using the Karvonen formula.

The participants' blood samples were obtained from an antecubital vein after overnight fasting between 8:00 AM and 10:00 AM in the early follicular phase on days 2 to 5. The samples were allowed to clot completely at room temperature, and then centrifuged within 30 min at 1500 g for 4 min. Serums were analyzed on a daily basis for estradiol (EM), follicle stimulating hormone (FSH) and luteinizing hormone (LH) by the electrochemiluminescense immunoassay

(ECLIA) method using an autoanalyzer (Cobas 6000, E 601 Roche Diagnostics, GmbH, Mannheim, Germany). The serums for AMH measurements were frozen at 20°C within 2 hours for 5 days at most and then analyzed. All analyses of AMH samples were also performed on a weekly basis by the ECLIA method using an autoanalyzer (Cobas 6000, E 601 Roche Diagnostics, GmbH, Mannheim, Germany).

STATISTICAL ANALYSIS

All analyses were performed using SPSS (Statistical Packages for The Social Sciences) software version 21 (SPSS Inc. Chicago, USA). The distributions of all of the continuous variables for normality were tested using Shapiro-Wilk tests. The data were not normally distributed. Differences between the experimental group and controls were tested with the non-parametric Wilcoxon matched-pairs signed-rank test. The significance level was at $p < 0.05$.

RESULTS

Table 1 depicts the demographic characteristics of the participants.

Table 2 shows the changes of anthropometric parameters during the study periods. There were significant differences in both groups' anthropometric parameters. However, body weight, BMI, fat %, waist and hip circumference decreased progressively from baseline throughout the training course in the experimental group ($p < 0.05$). By contrast, body weight, BMI, fat %, waist and hip circumference increased in the control group ($p < 0.05$).

Table 1. Demographic characteristics of the participants (mean ±SD)

Variable	Experimental group (N = 12) Mean ±SD	Control group (N = 14) Mean ±SD
Age (years)	34.25 ±2.59	32.57 ±2.17
Height (cm)	161.83 ±4.06	159.36 ±6.28
Weight (kg)	64.92 ±8.56	69.15 ±20.03
BMI (kg/m^2)	25.84 ±4.37	27.47 ±7.75

Table 2. Anthropometric measurements of participants during an 8-week program

Variables	Experimental group (N=12) Mean ±SD			Control group (N=14) Mean ±SD		
	Pre	Post	p	Pre	Post	p
Weight (kg)	64.92±8.56	62.5±7.67	0.00*	66.6±13.4	67.6±14.5	0.00*
BMI (kg/m^2)	25.8±4.37	24.2±4.21	0.00*	26.1±5.99	26.6±6.18	0.00*
Fat (%)	30.7±7.39	28.4±6.97	0.00*	31.8±8.83	32.4±8.88	0.00*
Waist (cm)	78.75±8.47	76.9±8.4	0.00*	87.4±16.1	88.8±17.2	0.00*
Hip (cm)	103.1±7.1	100.3±6.6	0.00*	103.3±11.5	104.1±12.3	0.00*
WHIR (cm)	0.76±0.65	0.76±0.07	0.43	0.84±0.06	0.85±0.06	0.53

*p-values indicate statistically significant (*p < 0.05)*

Table 3 shows the changes of hormones of the participants during the spinning exercise. AMH and EM significantly decreased from baseline throughout the spinning exercise in the experimental group ($p < 0.05$, $p = 0.05$ respectively). There were no significant differences in other hormones in the experimental group. In the control group, there were no significant differences in all hormones.

Table 3. Levels of hormones of participants during an 8-week program

Variables	Experimental group (N=12) Mean ±SD			Control group (N=14) Mean ±SD		
	Pre	Post	p	Pre	Post	p
Antimullerian hormone (ng/dL)	4.41 ±0.55	2.23 ±1.39	0.00*	3.90 ±1.47	4.08 ±2.50	0.73
Estradiol (pg/mL)	36.6 ±18.0	26.18 ±5.07	0.05	27.02 ±4.83	29.7 ±7.7	0.39
Follicle stimulating hormone (IU/L)	5.97 ±3.48	5.06 ±1.19	0.45	6.06 ±1.5	5.15 ±1.59	0.07
Luteining hormone (IU/L)	5.48 ±1.37	6.45 ±3.92	0.37	6.2 ±1.78	6.97 ±1.22	0.19

*p-values indicate statistically significant (*p < 0.05)*

DISCUSSION

The first finding of this study is that the spinning exercise program significantly decreased body weight, BMI, fat %, waist and hip circumference parameters in the experimental group (Table 2). Previous studies [27–30] reported that regular aerobic and strength exercises positively influenced physical and anthropometric parameters.

In view of the existing literature, the findings still remain inconclusive about the effect of exercise on ovarian reserve tests. In this study, we evaluated the impact of spinning exercise on ovarian reserve tests, especially on the AMH level. The finding of this study indicates that the serum AMH level (pre: 4.41 ±0.55; post: 2.23 ±1.39 ng/dL) and the EM level (pre: 36.6 ±18.0; post: 26.18 ±5.07 pg/mL) decreased following the spinning exercise program (Table 3). In addition, it was seen to decrease in FSH and increase in LH. Some previous studies [31] demonstrated a significant decrease in AMH after a 12-week endurance exercise program in women with PCOS. By contrast, physical exercise did not result in a decrease in AMH in obese women with PCOS in other studies [21, 32]. A study evaluating the effect of exercise on serum AMH and ovarian morphology revealed that physical exercise did not have such an effect, but a significant within-group decrease in antral follicle count [33]. Another study evaluating aerobic exercise in women with PCOS demonstrated an improvement in ovarian morphology independently of changes in the body composition [34]. A systemic review of exercise therapy in PCOS revealed that lifestyle modification, including exercise, was the first-line therapeutical option for improvements in reproductive outcomes. But, the physical activities involved in all studies were moderate intensity physical activity [35]. On the basis of these previous studies, the main reason for these findings is unclear, but there is a reasonable explanation. Spinning exercise, as in our study, can be considered as a high-intensity exercise mode [26]. Today, it is well known that strenuous physical activity causes anovulation and amenorrhea. It appears that a negative energy balance predisposes to impairment in pulsative gonadotropin secretion [25]. In our study, spinning exercise resulted in a decrease in the serum AMH level. This may be due to the negative effect of spinning exercise that results in a negative energy balance on ovarian reserve. Another possible mechanism may be negative feedback effect of strenuous exercise on the hypothalamic-pituitary-ovarian axis [40]. Moreover, hypothamic kisspeptins, a family of peptide hormones, also play a crucial role in regulation HPG axis, thus may constitute a link between energy balance and the ovarian reserve [41]. Life style modifications, such as exercise, yield a decrease in adipose tissue. Thereby, improvements in insulin sensitivity, sex-hormone-binding-globulin, ovulatory cycle, hypothamic functions, metabolic functions of fatty tissues and reduction in inflammation of fatty tissues have been noted. But the type, amount and duration of exercise required to improve reproductive outcomes are still unknown [36]. Many recent studies have also confirmed the positive impact of physical activity on ovarian reserve markers and fertility outcomes [37, 38]. However, Zanier [39] reported in parallel with our study that vigorous physical activity was associated with a negative impact on fertility outcomes. This was attributed to negative energy balance in exercising women. A potential limitation of our study that should be mentioned is the small size of the study population because the financial source of the study is limited. Another limitation is that the living area of the study population is limited for many opportunities. Thereby, women living in different regions and of different ages should be included in such a study. It was seen that spinning exercises may be capable of weight loss, reduction in the fat percentage, waist and hip circumference. Spinning exercise intensity may be reduced, or aerobic exercises may be added.

CONCLUSIONS

Heavy exercises such as spinning are associated with a decreased AMH level in reproductive-young women as an ovarian reserve test. Therefore, strenuous exercises may not be advised to the women with a poor ovarian reserve. The mechanism of decline should be investigated by further studies in a larger series. Middle-aged women doing spinning exercise who want to have children should reduce the exercise load. For further research, a large scale longitudinal study across the spinning exercise is needed to find out the underlying causes of a decrease in AMH in reproductive-age young women.

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Cite this article as:

Gorkem U, Yamaner F, Demirkan E, Inal HA.
Does the spinning exercise affect the ovarian reserve in reproductive-young women?
Balt J Health Phys Act. 2018;10(4): 175-181.
doi: 10.29359/BJHPA.10.4.16